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चिकित्सीय विद्युत उपस्कर — विद्युत-प्रकाशिक एक्स-रे बिम्ब तव्रिकारकों के अभिलक्षण

भाग 1 प्रवेश क्षेत्र का साइज़ ज्ञात करना

Indian Standard

MEDICAL ELECTRICAL EQUIPMENT — CHARACTERISTICS OF ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIERS

PART 1 DETERMINATION OF THE ENTRANCE FIELD SIZE

ICS 11.040.50

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 2010 Price Group 4

Ionizing Radiation Imaging and Radiotherapy Equipment Sectional Committee, MHD 18

NATIONAL FOREWORD

This Indian Standard (Part 1) which is identical with IEC 61262-1 : 1994 'Medical electrical equipment — Characteristics of electro-optical X-ray image intensifiers — Part 1: Determination of the entrance field size' issued by the International Electrotechnical Commission (IEC) was adopted by Bureau of Indian Standards on the recommendation of Ionizing Radiation Imaging and Radiotherapy Equipment Sectional Committee and approval of the Medical Equipment and Hospital Planning Division Council.

This standard was first published in 1993 as IS 13728 :1993 'Entrance field sizes of electro-optical X-ray image intersifiers' by adopting IEC 520-(1975). IEC 520 (1975) had been withdrawn and replaced by IEC 61262-1 : 1994. This standard will therefore supersede IS 13728 : 1993 and after the publication of this standard IS 13728:1993 shall be treated as withdrawn.

This standard considers both the nominal entrance field size and the useful entrance field size. The nominal entrance field size is calculated from several useful entrance field size measurements. Measurements of the useful entrance field size in the magnification modes of the electro-optical X-ray image intensifier is also considered in this standard.

The entrance field size of electro-optical X-ray image intensifier can be specified in several ways depending on the specified source to entrance plane distance (SED). Typically, the entrance field size is specified as a nominal entrance field size or as a useful entrance field size. The source to entrance plane distance (SED) for the nominal entrance field size is infinite, while the useful entrance field size is measured at a specified SED, usually one metre.

IEC 61262 has been published in various parts. The other parts which have been adopted so far are:

Part 2	Determination of the conversion factor
Part 3	Determination of the luminance distribution and luminance non-uniformity

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 788 :1984[1)] Medical radiology — Terminology	IS 13807 : 1994 Medical radiology — Terminology	Identical

Only the English language text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in the IEC Standard.

[1)] Since revised in 2004.

(Continued on third cover)

Indian Standard

MEDICAL ELECTRICAL EQUIPMENT — CHARACTERISTICS OF ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIERS

PART 1 DETERMINATION OF THE ENTRANCE FIELD SIZE

1 Scope

This International Standard applies to ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIERS for medical use, as components of diagnostic X-RAY EQUIPMENT.

This International Standard describes a method of determining the ENTRANCE FIELD SIZE of X-RAY IMAGE INTENSIFIERS.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 788: 1984, *Medical Radiology - Terminology*

3 Terminology

3.1 *Definitions*

For the purposes of this International Standard, the following definitions apply together with those given in IEC 788. The definitions given below take preference over those given in IEC 788 when differences occur.

3.1.1 *XRII:* An abbreviation for ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIER.

3.1.2 *ENTRANCE PLANE:* The plane perpendicular to the axis of symmetry of the XRII and grazing the part of the XRII, including its housing, that protrudes most in the direction of the RADIATION SOURCE.

3.1.3 *ENTRANCE FIELD:* For an XRII, the area in the ENTRANCE PLANE that can be used for the transmission of an X-RAY PATTERN under specific conditions.

3.1.4 *ENTRANCE FIELD SIZE:* For an XRII, the diameter of the field in the ENTRANCE PLANE that can be used at a specified SED for the transmission of an X-RAY PATTERN. For an XRII with more than one magnification mode, the ENTRANCE FIELD SIZE for each of the magnification modes shall correspond to the same diameter of the XRII OUTPUT IMAGE occurring with the largest ENTRANCE FIELD SIZE.

3.1.5 *SOURCE TO ENTRANCE PLANE DISTANCE (abbreviation SED):* The distance between the FOCAL SPOT of the X-RAY TUBE and the ENTRANCE PLANE of the XRII.

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3.1.6 *CENTRE OF THE OUTPUT IMAGE:* The centre of the smallest circle circumscribing the OUTPUT IMAGE.

3.1.7 *CENTRE OF THE ENTRANCE FIELD:* That point in the ENTRANCE PLANE which is imaged at the CENTRE OF THE OUTPUT IMAGE.

3.1.8 *CENTRAL AXIS:* The line perpendicular to the ENTRANCE PLANE passing through the CENTRE OF THE ENTRANCE FIELD.

3.1.9 Not used

3.1.10 *NOMINAL ENTRANCE FIELD SIZE:* The ENTRANCE FIELD SIZE of the XRII that would be achieved with a parallel beam of IONIZING RADIATION with the RADIATION SOURCE approaching infinity.

3.1.11 *USEFUL ENTRANCE FIELD SIZE:* The ENTRANCE FIELD SIZE measured at the ENTRANCE PLANE of the XRII at a specified SED.

3.2 *Degree of requirements and reading instructions*

In this International Standard the auxiliary verb:

– "shall"	implies that compliance with a requirement is mandatory for compliance with the standard;
– "should"	implies that compliance with a requirement is strongly recommended but is not mandatory for compliance with the standard;
– "may"	implies that compliance with a requirement is permitted to be accomplished in a particular manner, for compliance with the standard;

and the following words have the meaning:

– "specific"	when used in combination with parameters or conditions: refers to a particular value or standardized arrangement, usually to those required in an IEC standard or a legal requirement; see IEC 788, rm-74-01.
– "specified"	when used in combination with parameters or conditions: refers to a value or arrangement to be chosen for the purpose under consideration and indicated usually in ACCOMPANYING DOCUMENTS; see IEC 788, rm-74-02.
– "designed for"	when used in standards to characterize equipment, devices, components or arrangements: designates an intended and usually apparent purpose or use for the product.

4 Requirements

The instrumentation characteristics and the settings needed for the determination of the ENTRANCE FIELD SIZE are given here.

4.1 *Test set-up*

a) The SED shall be 100 cm ± 1 cm.

To determine the NOMINAL ENTRANCE FIELD SIZE, an additional measurement is required at an SED that is different from 100 cm. For this measurement, an SED of about 50 cm is recommended.

b) The FOCAL SPOT of the X-RAY TUBE shall be on the CENTRAL AXIS.

c) The X-RAY FIELD shall cover the ENTRANCE FIELD entirely.

4.2 *X-RAY IMAGE INTENSIFIER - Operating conditions*

a) The XRII shall be operated under the conditions for NORMAL USE as specified by the manufacturer.

b) Not used.

c) In the case of multiple-field XRIIs, the measurement shall be made for the largest specified ENTRANCE FIELD. Measurements for other ENTRANCE FIELDS are optional.

4.3 *Input radiation*

The combination of the ATTENUATION EQUIVALENT of the TEST DEVICE and the RADIATION QUALITY used for the determination of the values of magnification shall be such that the image of the TEST DEVICE has a high contrast. The radiation intensity shall be sufficient to obtain an image at a low noise level.

4.4 *TEST DEVICE*

a) The TEST DEVICE shall be a radio-opaque scale sufficient in size to cover the normal mode of the XRII. The smallest division of the scale shall not be larger than 2,0 mm.

b) The TEST DEVICE shall have two orthogonal scales to facilitate centering of the device in the ENTRANCE FIELD.

c) The TEST DEVICE shall be placed tangent to the ENTRANCE PLANE.

4.5 *Measurement equipment*

A telescope or microscope is recommended to view the OUTPUT IMAGE for alignment of the TEST DEVICE in the ENTRANCE FIELD. The telescope or microscope is also suggested for the determination of the actual measurement of the ENTRANCE FIELD SIZE.

5 Determination of the USEFUL ENTRANCE FIELD SIZE and NOMINAL ENTRANCE FIELD SIZE

5.1 *Preparation*

a) The **TEST DEVICE** shall be placed in a plane as close as possible to, but not more than 10 mm in front of, and parallel to the **ENTRANCE PLANE.**

b) The centre of the **TEST DEVICE** shall be on the **CENTRAL AXIS.**

c) For measuring the **USEFUL ENTRANCE FIELD SIZE** the SED shall be adjusted to 100 cm ± 1 cm, see 4.1 a).

5.2 *Measurement*

a) While the XRII is irradiated, determine the maximum dimension of the **TEST DEVICE £S** seen in the **OUTPUT IMAGE** with the SED at 100 cm ± 1 cm. The use of a telescope or microscope to view the **OUTPUT IMAGE** is suggested to improve accuracy.

In order to measure the **USEFUL ENTRANCE FIELD SIZE** in the magnification modes, it is necessary to make a relative or absolute measurement of the **OUTPUT IMAGE** diameter in the normal or non-magnification mode. The **USEFUL ENTRANCE FIELD SIZE** for each of the magnification modes shall correspond to the same diameter of the XRII **OUTPUT IMAGE**, as the one occurring in the normal mode of the XRII.

b) Repeat the measurement as described in 5.2 a) with an SED of about 50 cm for the determination of the **NOMINAL ENTRANCE FIELD SIZE.**

5.3 *Corrections*

Not used.

5.4 *Determination*

The **USEFUL ENTRANCE FIELD SIZE** is a direct measurement requiring no calculations or corrections. However, to determine the **NOMINAL ENTRANCE FIELD SIZE** a calculation based on data taken at two different SEDs is needed.

The **NOMINAL ENTRANCE FIELD SIZE** is calculated as follows:

$$d_3 = [d_1 \times d_2 \times (A - B)] / [(A \times d_1) - (B \times d_2)]$$

where

d_1 is the USEFUL ENTRANCE FIELD SIZE corresponding to $\Phi'/2$ (i.e. SED = B)

d_2 is the USEFUL ENTRANCE FIELD SIZE corresponding to $\Phi/2$ (i.e. SED = A)

d_3 is the **NOMINAL ENTRANCE FIELD SIZE** of the XRII

See annex B and figure B.1 for derivation of the **NOMINAL ENTRANCE FIELD SIZE.**

6 Presentation of the ENTRANCE FIELD SIZE

The presentation of the **ENTRANCE FIELD SIZE** shall include the following information:

- XRII identification, e.g., generic type, model name or number.
- For each magnification mode, **USEFUL ENTRANCE FIELD SIZE.**

and optionally:

- The **NOMINAL ENTRANCE FIELD SIZE.**

7 Statement of compliance

If compliance with this standard for the determination of the **ENTRANCE FIELD SIZE** of X-**RAY IMAGE INTENSIFIERS** is to be stated, it shall be indicated as:

- Useful entrance field size: IEC 1262-1: 1994.

and optionally

- Nominal entrance field size: IEC 1262-1: 1994.

Annex A
(informative)

Terminology - Index of terms

IEC 788	rm-..-..
Name of unit in the International System SI	rm-..-..*
Derived term without definition	rm-..-..+
Term without definition	rm-..-..-
Name of earlier unit	rm-..-..•
Shortened term	rm-..-..s
Subclause 3.1 of IEC 1262-1 (present publication)	3.1.

ACCOMPANYING DOCUMENTS	rm-82-01
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CENTRAL AXIS	3.1.8
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RADIATION SOURCE	rm-20-01
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X-RAY EQUIPMENT	rm-20-20
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X-RAY IMAGE INTENSIFIER	rm-32-39
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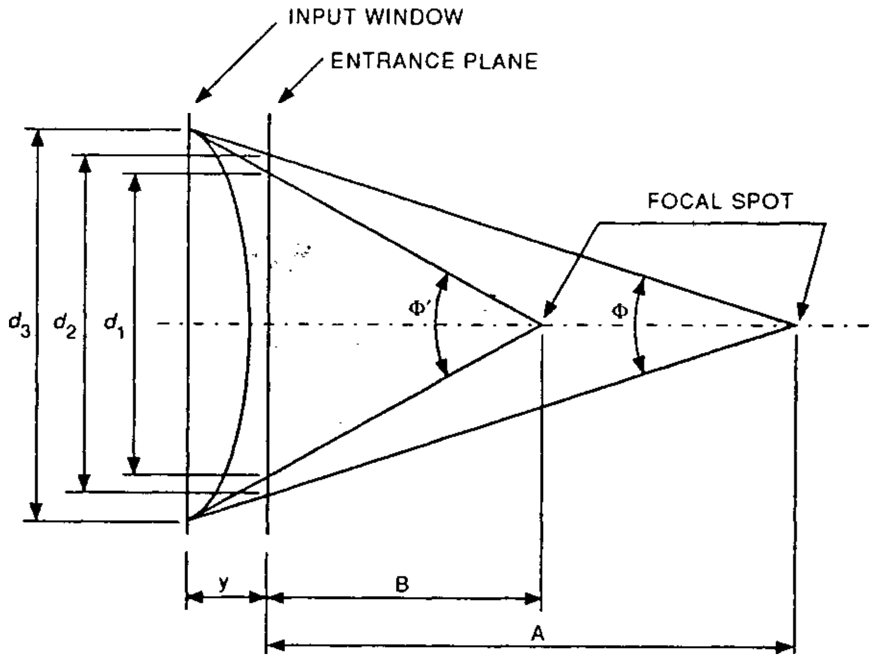
X-RAY TUBE	rm-22-03
XRII	3.1.1

Annex B
(informative)

Derivation of the NOMINAL ENTRANCE FIELD SIZE

Refer to the following figure and the subsequent calculation of the **NOMINAL ENTRANCE FIELD SIZE**.



d_1 is the useful entrance field size corresponding to Φ'/2 (i.e. SED = *B*)
d_2 is the useful entrance field size corresponding to Φ/2 (i.e. SED = *A*)
d_3 is the NOMINAL ENTRANCE FIELD SIZE of XRII at input window

Figure B.1 - Geometry of test set-up

From figure:

(1) $\tan(\Phi/2) = (d_2 / 2) / A = (d_3 / 2) / (y + A)$

(2) $\tan(\Phi'/2) = (d_1 / 2) / B = (d_3 / 2) / (y + B)$

Solving the above equations for *y*:

(3) $y = [(d_3 \times A) / d_2] - A$

(4) $y = [(d_3 \times B) / d_1] - B$

Solving d_3 using (3) and (4)

(5) $[(d_3 \times A) / d_2] - A = [(d_3 \times B) / d_1] - B$

(6) $d_3 = [d_1 \times d_2 \times (A - B)] / [(A \times d_1) - (B \times d_2)]$

where d_3 = NOMINAL ENTRANCE FIELD SIZE.

(Continued from second cover)

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values *(revised)'.The* number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website:* www.bis.org.in

Regional Offices:		*Telephones*
Central :	Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	2323 7617 2323 3841
Eastern :	1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	2337 8499, 2337 8561 2337 8626, 2337 9120
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